FTD-TT- 63-46

633-2

TRANSLATION

CASTING IN VIBRATION MOLDS

By

V. A. Povidaylo, R. I. Silin and V. A. Shchigel'

FOREIGN TECHNOLOGY DIVISION

AIR FORCE SYSTEMS COMMAND

WRIGHT-PATTERSON AIR FORCE BASE
OHIO

FTD-TT- 63-46/1+2

UNEDITED ROUGH DRAFT TRANSLATION

CASTING IN VIBRATION MOLDS

BY: V. A. Povidaylo, R. I. Silin and V. A. Shchigel'

English Pages: 6

SOURCE: Russian Book, Vibratsionnyye Ustroystva v Mashinostroyenii, Moscow, 1962, pp 89-94

THIS TRANSLATION IS A RENDITION OF THE ORIGINAL FOREIGN TEXT WITHOUT ANY ANALYTICAL OR EDITORIAL COMMENT. STATEMENTS OR THEORIES ADVOCATED OR IMPLIED ARE THOSE OF THE SOURCE AND DO NOT NECESSARILY REFLECT THE POSITION OR OPINION OF THE FOREIGN TECHNOLOGY DIVISION.	PREPARED BY: TRANSLATION DIVISION FOREIGN TECHNOLOGY DIVISION WP-AFB, OHIO.

FTD-TT- 63-46/1+2 Date 1 April 19 63

Casting in Vibration Molds

by

V. A. Povidaylo, R. I. Silin and V. A. Shchigel'

The idea of improving the properties of cast steel by vibration in the process of solidification was mentioned for the first time by D.K.Chernov back in 1868. Practical vibration of iron chill molds was realized by K.M.Korol'kov and N.I.Smirnov under industrial conditions when casting avia pistons from aluminum alloys in 1938. During ordinary casting of details of this type was observed greater waste due to gas blow holes. With the use of vibration waste was reduced considerably, because the liberation of gas from the metal has become easier. There was also an improvement in the quality of castings, explained by the overcoming of surface tension of the molten metal and as result of facilitating the flow of the melt and filling the forms. A study of the structure of metal castings, casted and solidified in a vibrating form, showed, that the structure is much finer and more denser as compared with the structure of an alloy, obtained by casting under conventional conditions.

The mechanical properties of pig iron in castings, obtained by the use of vibration, have increased in the following manner: yield point from 12.3 to 15.2 kg/mm^2, hardness increased from 170 to 197 units by Brinell at a more uniform and eddy form of graphite inclusions. The waste due to gas blow holes, often observed on these castings obtained by the conventional method, was totally liquidated by the employment

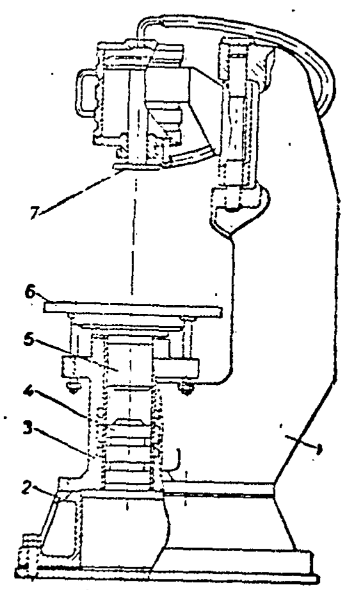

Fig.37. Vibratory die-casting mold

of vibration.

Investigations showed, that employing vibration for the metal solidifying in the form, it is possible to actively influence the process of formation of the alloy's structure. This influence consists in the following: the structure of the metal is highly refined; structural heterogeneity of castings is eliminated; the content of hydrogen, which leads to elimination or sharp reduction in waste due to gas blow holes, decreases considerably; the process of shrinkage, as result of which shrinkage porosity is decreased and the density of casted detail increases, is made easier; the process of metal crystallization is speeded up.

In this way vibration can eliminate or considerably reduce the basic defects in the structure of steel, cast iron and non-ferrous metal castings.

To utilize vibration during the casting of metal it is necessary to fix the processing conditions - frequency, amplitude, duration. The fixed vibration parameters depend upon the tenacity of the fusion, and upon the chemical composition, temperature etc. In this connection the condition of processing the alloy is set up experimentally.

The employment of vibration in foundry industry requires no expensive and complex equipment.

The mechanisms necessary for this purpose can be made by the efforts of mechanical workshops of any given medium capacity plant.

In fig.38 is shown one of the constructions of a vibration casting machine for the casting of components weighing 30-100 kg. The machine consists of a pneumatic cylinder 1, assuring with the aid of a connecting piece 2, crossarm 3 and bearing plates 5 and 7 disassembly and assembly of two metal half-forms.. The carrier plates are supported against semirigid bases in form of heavy springs 11. The springs 11 are secured by bolts 10 with crossarm 3 and cross beam 9, and also with the carrier plates. To release the left springs 11 between crossarm 3 and plate 5 is placed a

flexible coupling 4. To plate 7 is attached a special inertia vibrator 8, driven by electric motor 12 with a capacity of 3.5 - 4 kw through a corresponding shaft and coupling. 6

On this machine can be casted details into chill molds or, if half forms are assembled and plates 5 and 7 are jointed, in sand molds, placed on the upper horizontal surface of the plates.

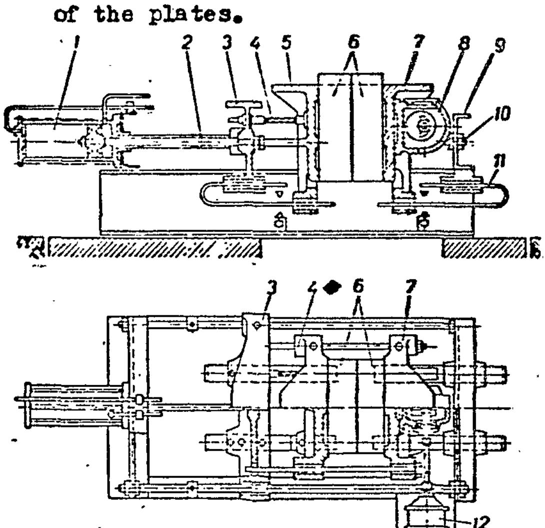

Fig.38, Vibration casting machine

Use of vibration for shaking out casting boxes.

The work in the department of shaking out casting boxes consists in freeing same from the castings and loam; particularly difficult because of greater amount of dust from the shaken out loam and thermal radiation of the cooling off castings. To liquidate hard physical labor and sharply reduce the labor effort of this operation it is necessary to automate the shaking out job, as well as the loading and unloading of the shaking out mechanism.

To mechanize the shaking out of casting boxes various vibrational mechanisms have been employed for a long time, mechanisms using inertia forces, originating as result of vibration. Since such mechanisms are being widely employed, their mode of operation is not being discussed in detail, but only in role of an example (fig.39) is given one of the constructions of an excentric vibration lattice (screen)

The load lifting capacity of the screen is 1.5 ton. The screen has four inclined positions within limits of from 0 to 6°. The oscillation (vibration) frequency of the grating (screen) equals 725 per min. Vibration is realized by the rotation of a crankshaft. Eccentricity of the shaft, and consequently, also the amplitude of vibrations - 3 mm.

The frame of grating 15 represents a rigid construction assembled on bolts.

In the bearings attached on the frame 10 is mounted the crankshaft 11, bearing the frame of grating 4. The shaft is protected by housing 3. To avoid overheating of bearings 12 of the grating frame on the shaft housing is a hollows 13, in which water is circulating. Water is delivered from a water mains and dischargedinto sewage through rubber hoses. To absorb the inertia of the grating on the shaft is placed a counterweight 14. Rotation of the shaft is realized by and electric motor 1 with a capacity of 4 kw at 725 rpm through an elastic coupling 2.

See Attachment 4a for Fig. 39

Fig. 39, Eccentric vibration grating

To the frame of the grating are screwed on cramp irons 5, supported against rubber shock absorbers. Each of the four shock absorbers, situated along the corners of the grating has an angle bracket 7, which is placed between upper and lower buffers. The upper buffer 6 absorbs the forces, directed downwards, and lower buffer 8 acts during the lifting of the grating by the camshaft. To change the angle of inclination of the grating bolts 9 securing the shock absorber angle braked are reset.

The grating is mounted over a special tunnel, provided with exhaust ventilation. The shaken out loam is poured through the grating into a transporter, placed in the tunnel.

By construction and method of vibrating the mechanisms for shaking out casting boxes can be different, but they are always based on the utilization of inertia forces.

Vibration transporters of foundry shops

In recent years foundry shops are more frequently employing vibration transporters and lifters. This is explained by their universality, possibility of easily controlling productiveness, reliability, long service life, capability of working at high temperatures, possibility of total hermetization. It should be mentioned, that

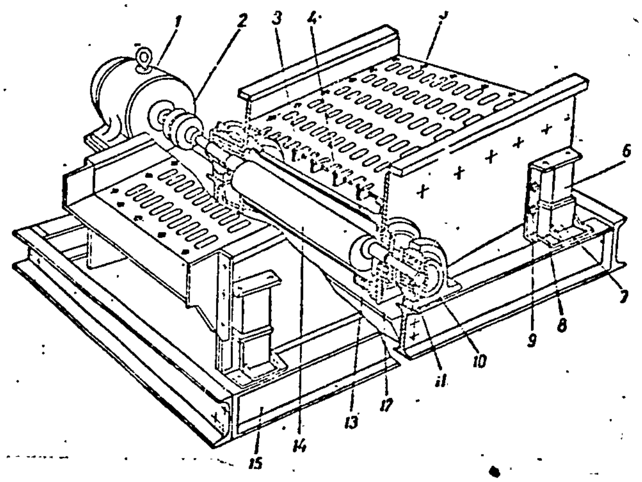

Fig. 39. Eccentric vibration grating

lifters (hoisters) (spiral transporters) in addition to the job of transporting can also be used for preparing the mold mixtures in small and medium size workshops as cooling towers for depleted molding mixture, for moistening the mixture.

Use of vibration in machine construction during processing, assembling and control.

Until recently any vibrations, originating during the machining of metals by milling, was considered an extremely undesirable phenomanon, because they had a negative effect on the purity and accuracy of the machined surface and on the stability of the tool as well. The entire investigation on the nature of vibration in the process of cutting was intended for combatting same, as result of which a greater number of universal vibration damping constructions of units of metal cutting machines has been created. But investigations of recent years have shown that not all vibrations have a negative effect on the process of cutting. It was discovered, that specially created and directed vibrations do not reduce the conditions of the cutting process, but even improve the effectiveness of the vibration, improving the quality of machined surface and increasing the stability of the tool. Use of vibration in the role of main cutting movement enabled to create new highly effective technological processes of lapping and finishing of details.

DISTRIBUTION LIST

DEPARTMENT OF DEFENSE	Nr. Copies	MAJOR AIR COMMANDS	Nr. Copies
		AFSC	
		SCFDD	1
		ASTIA	25
HEADQUARTERS USAF		TDBTL	5
		TDBDP	5
AFCIN-3D2	1	AFMDC (MDF)	1
ARL (ARB)	1	ASD (ASYIM)	1
OTHER AGENCIES			
CIA	1		
NSA	6		
DIA	9		
AID	2		
OTS	2		
AEC	2		
PWS	1		
NASA	1		
ARMY	3		
NAVY	3		
RAND	1		
NAFEC	1		